

RTCA Special Committee 186, Working Group 3

ADS-B 1090 MOPS, Revision A

Meeting #4

Alternate Test For Preamble Pulse Tolerance Enhancement

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SUMMARY

Alternate Test For Preamble Pulse Tolerance Enhancement

(alternate test for 2.4.4.3.4.7.1)

Verification of Criteria for ADS-B Message Transmission Pulse Detection (Enhanced Method) (subparagraph TBD)

Purpose/Introduction:

These tests verify that the ADS-B reply processor correctly detects the presence of a valid ADS-B preamble whose pulse characteristics are within the allowable limits and rejects preambles having pulse spacing and position characteristics that are outside the allowable limits.

Reference Input:

Equipment:

Provide a method of supplying the UUT with:

Any Valid ADS-B Message having:

“DF”	=	17
“CA”	=	0
“AA”	=	Any discrete address
Message Rate	=	50 Hz
Frequency	=	1090 MHz
Power	=	-23 dBm (for the first preamble pulse level)

Input A:

Same as the **Reference Input**, but having the following preamble pulse characteristics:

Table 2-111: Input A: Preamble Pulse Characteristics

Input A: Preamble Pulse Characteristics					
Pulse	Rise time (μsec)	Fall time (μsec)	Δ Width (μsec)	Δ Position (μsec)	Δ Amplitude (dB)
1	0.05 - 0.1	0.05 - 0.2	+0.05	—	—
2	0.05 - 0.1	0.05 - 0.2	-0.05	+0.125	+2
3	0.05 - 0.1	0.05 - 0.2	+0.05	+0.125	+2
4	0.05 - 0.1	0.05 - 0.2	-0.05	+0.125	0

Input B:

Same as the **Reference Input**, but having the following preamble pulse characteristics:

Table 2-111: Input B: Preamble Pulse Characteristics

Input B: Preamble Pulse Characteristics					
Pulse	Rise time (μsec)	Fall time (μsec)	Δ Width (μsec)	Δ Position (μsec)	Δ Amplitude (dB)
1	0.05 - 0.1	0.05 - 0.2	+0.05	—	—
2	0.05 - 0.1	0.05 - 0.2	-0.05	-0.125	+2
3	0.05 - 0.1	0.05 - 0.2	+0.05	-0.125	+2
4	0.05 - 0.1	0.05 - 0.2	-0.05	-0.125	0

Input C:

Same as the **Reference Input**, but having the following preamble pulse characteristics:

Table 2-112: Input C: Preamble Pulse Characteristics

Input C: Preamble Pulse Characteristics					
Pulse	Rise time (μsec)	Fall time (μsec)	Δ Width (μsec)	Δ Position (μsec)	Δ Amplitude (dB)
1	0.05 - 0.1	0.05 - 0.2	-0.3	—	—
2	0.05 - 0.1	0.05 - 0.2	-0.3	0	0
3	0.05 - 0.1	0.05 - 0.2	-0.3	0	0
4	0.05 - 0.1	0.05 - 0.2	-0.3	0	0

Input D:

Same as the **Reference Input**, but having the following preamble pulse characteristics:

Table 2-113: Input D: Preamble Pulse Characteristics

Input D: Preamble Pulse Characteristics					
Pulse	Rise time (μsec)	Fall time (μsec)	Δ Width (μsec)	Δ Position (μsec)	Δ Amplitude (dB)
1	0.05 - 0.1	0.05 - 0.2	0	—	—
2	0.05 - 0.1	0.05 - 0.2	0	+0.2	0
3	0.05 - 0.1	0.05 - 0.2	0	+0.2	0
4	0.05 - 0.1	0.05 - 0.2	0	+0.2	0

Input E:

Same as the **Reference Input**, but having the following preamble pulse characteristics:

Table 2-111: Input E: Preamble Pulse Characteristics

Input E: Preamble Pulse Characteristics					
Pulse	Rise time (μsec)	Fall time (μsec)	Δ Width (μsec)	Δ Position (μsec)	Δ Amplitude (dB)
1	0.05 - 0.1	0.05 - 0.2	0	—	—
2	0.05 - 0.1	0.05 - 0.2	0	-0.125	0
3	0.05 - 0.1	0.05 - 0.2	0		0
4	0.05 - 0.1	0.05 - 0.2	0	+0.125	0

Input F:

Same as the **Reference Input**, but having the following preamble pulse characteristics:

Table 2-111: Input F: Preamble Pulse Characteristics

Input F: Preamble Pulse Characteristics					
Pulse	Rise time (μsec)	Fall time (μsec)	Δ Width (μsec)	Δ Position (μsec)	Δ Amplitude (dB)
1	0.05 - 0.1	0.05 - 0.2	0	—	—
2	0.05 - 0.1	0.05 - 0.2	0	0	0
3	0.05 - 0.1	0.05 - 0.2	0	+0.125	0
4	0.05 - 0.1	0.05 - 0.2	0	-0.125	0

Input G:

Same as the **Reference Input**, but having the following preamble pulse characteristics:

Table 2-114: Input G: Preamble Pulse Characteristics

Input G: Preamble Pulse Characteristics					
Pulse	Rise time (μsec)	Fall time (μsec)	Δ Width (μsec)	Δ Position (μsec)	Δ Amplitude (dB)
1	0.05 - 0.1	0.05 - 0.2	+4.5	—	—
2					
3		Not Present			
4					

Measurement Procedure:

The ADS-B receiver power levels specified in this procedure are relative to the loss at the RF message source end of the transmission line used to interface the RF message source to the UUT receiver input port. For each ADS-B equipage

class, the specified power level shall be adjusted to compensate for the maximum line loss for which the UUT receiver has been designed. For example, if the line loss is 3 dB, then each of the RF message power levels specified in the test procedures shall be lowered by 3 dB.

Step 1: Preamble Pulse Characteristics set to the Extreme Limits of their Tolerance Range - Part 1

Apply **Input A** at the receiver input and verify that at least 90 percent of the ADS-B messages are correctly decoded.

Step 2: Preamble Pulse Characteristics set to the Extreme Limits of their Tolerance Range - Part 2

Repeat Step 1 with the signal power level at -65 dBm.

Step 3: Preamble Pulse Characteristics set to the Extreme Limits of their Tolerance Range - Part 3

Apply **Input B** at the receiver input and verify that at least 90 percent of the ADS-B messages are correctly decoded.

Step 4: Preamble Pulse Characteristics set to the Extreme Limits of their Tolerance Range - Part 4

Repeat Step 1 with the signal power level at -65 dBm.

Step 5: Preamble Pulse Widths set to Out-of-Tolerance Values - Part 1

Apply **Input C** at the receiver input and verify that no more than 10 percent of the ADS-B messages are correctly decoded.

Step 6: Preamble Pulse Widths set to Out-of-Tolerance Values - Part 2

Repeat Step 3 with the signal power level at -65 dBm.

Step 7: Preamble Pulse Positions set to Out-of-Tolerance Values - Part 1

Apply **Input D** at the receiver input and verify that no more than 10 percent of the ADS-B messages are correctly decoded.

Step 8: Preamble Pulse Positions set to Out-of-Tolerance Values - Part 2

Repeat Step 5 with the signal power level at -65 dBm.

Step 9: Preamble Pulse Positions set to Out-of-Tolerance Values - Part 3

Apply **Input E** at the receiver input and verify that no more than 10 percent of the ADS-B messages are correctly decoded.

Step 10: Preamble Pulse Positions set to Out-of-Tolerance Values - Part 4

Repeat Step 5 with the signal power level at -65 dBm.

Step 11: Preamble Pulse Positions set to Out-of-Tolerance Values - Part 5

Apply **Input F** at the receiver input and verify that no more than 10 percent of the ADS-B messages are correctly decoded.

Step 12: Preamble Pulse Positions set to Out-of-Tolerance Values - Part 6

Repeat Step 5 with the signal power level at -65 dBm.

Step 13: Preamble Single Pulse - Part 1

Apply **Input G** at the receiver input and verify that no more than 10 percent of the ADS-B messages are correctly decoded.

Step 14: Preamble Single Pulse - Part 2

Repeat Step 7 with the signal power level at -65 dBm.

ADDITIONAL TEST FOR NINE PULSE PREAMBLE DETECTION

Verification of Criteria for ADS-B Message Nine-Pulse Preamble Detection (subparagraph TBD)

Purpose/Introduction:

These tests verify that the ADS-B reply processor correctly detects the presence of a valid ADS-B nine-pulse preamble. It is verified that when energy is contained in at least one chip of the first five data bits the preamble is accepted and the preamble is rejected if one or more of the first five data bits has no energy in either chip. The acceptance criteria for the P1, P2, P3 and P4 pulses of the preamble are verified in subparagraph 2.4.4.3.4.7.1 or “new alternate test”

Reference Input:

Equipment:

Provide a method of supplying the UUT with:

Any Valid ADS-B Message having:		
“DF”	=	17
“CA”	=	0
“AA”	=	Any discrete address
Message Rate	=	50 Hz
Frequency	=	1090 MHz
Power	=	-23 dBm

The transmitted power in the first six data bits shall be controlled in such a way that a data bit can occur with no power being transmitted in either chip.

Measurement Procedure:

The ADS-B receiver power levels specified in this procedure are relative to the loss at the RF message source end of the transmission line used to interface the RF message source to the UUT receiver input port. For each ADS-B equipage class, the specified power level shall be adjusted to compensate for the maximum line loss for which the UUT receiver has been designed. For example, if the line loss is 3 dB, then each of the RF message power levels specified in the test procedures shall be lowered by 3 dB.

For this test to be valid the receiver must perform error correction.

Step 1: Nine-Pule Preamble Detection – Missing First Data Bit - Part 1

Input the DF=17 messages with no energy in either chip of the first data bit into the receiver and verify that less than 10 percent of the ADS-B messages are correctly decoded.

Step 2: Nine-Pule Preamble Detection – Missing First Data Bit - Part 2

Repeat Step 1 with the signal power level at -65 dBm.

Step 3: Nine-Pule Preamble Detection – Missing Second Data Bit - Part 1

Input the DF=17 messages with no energy in either chip of the second data bit into the receiver and verify that less than 10 percent of the ADS-B messages are correctly decoded.

Step 4: Nine-Pule Preamble Detection – Missing Second Data Bit - Part 2

Repeat Step 1 with the signal power level at -65 dBm.

Step 5: Nine-Pule Preamble Detection – Missing Third Data Bit - Part 1

Input the DF=17 messages with no energy in either chip of the third data bit into the receiver and verify that less than 10 percent of the ADS-B messages are correctly decoded.

Step 6: Nine-Pule Preamble Detection – Missing Thirdd Data Bit - Part 2

Repeat Step 1 with the signal power level at -65 dBm.

Step 7: Nine-Pule Preamble Detection – Missing Fourth Data Bit - Part 1

Input the DF=17 messages with no energy in either chip of the first data bit into the receiver and verify that less than 10 percent of the ADS-B messages are correctly decoded.

Step 8: Nine-Pule Preamble Detection – Missing Fourth Data Bit - Part 2

Repeat Step 1 with the signal power level at -65 dBm.

Step 9: Nine-Pule Preamble Detection – Missing Fifth Data Bit - Part 1

Input the DF=17 messages with no energy in either chip of the fifth data bit into the receiver and verify that less than 10 percent of the ADS-B messages are correctly decoded.

Step 10: Nine-Pule Preamble Detection – Missing fifth Data Bit - Part 2

Repeat Step 1 with the signal power level at -65 dBm.

Step 11: Nine-Pule Preamble Detection – Missing Sixth Data Bit - Part 1

Input the DF=17 messages with no energy in either chip of the sixth data bit into the receiver and verify that greater than 90 percent of the ADS-B messages are correctly decoded.

Step 12: Nine-Pule Preamble Detection – Missing Sixth Data Bit - Part 2

Repeat Step 1 with the signal power level at -65 dBm.